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NOTE ON ENSTATITE, HYPERSTHENE, AND ACTINOLITE

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In the course of an investigation of the compressibility of minerals and rocks, L. H. Adams and E. D. Williamson,¹ of this Laboratory, have examined the minerals which form the subjects of this paper. We have studied, optically and chemically, the specimens examined by them, so as to collate some of their properties. The results of our observations are presented here, in the belief that such determinations, made on identical material, may be of more general value than similar determinations made on materials which are not definitely identical.

ENSTATITE, ESPEDALEN, NORWAY

The material was a portion of a large, rough crystal, which was collected by Dr. Olaf Anderson, in 1914. The exact locality is "Espedalen, Vegaardsheien," in the Parish of Nedenes, about 15 kilometers west of Risör.

The mineral is light smoke gray, translucent, and almost colorless in thin plates. The optical examination (by H. E. M.) shows that the material is homogeneous, except for about 1 to 2 per cent of an intergrown mineral, which perhaps is muscovite. The optical properties are: optically positive, $a = 1.666$, $\gamma = 1.675$, β (calculated) = 1.670, $2V =$ about 75° . Adams found the *density*² to be 3.254 at 29° .

A chemical analysis (by H. S. W.), on material dried at 110° , gave the following results.

¹ To be published in *Jour. Franklin Inst.*, 195, 1923.

² The distinction is made here between *density* (the number of grams per cubic centimeter) and *specific gravity* which is the ratio of the density of the mineral to that of water, usually, among mineralogists, at the same temperature. Density is much to be preferred because it varies very little with temperature. The density of a mineral is obtained by multiplying the specific gravity of the mineral by that of water at the given temperature.

SiO ₂	57.28	.955	.956	1.000
TiO ₂	0.05	.001		
Al ₂ O ₃	0.90	.009		
Fe ₂ O ₃	0.42	.003		
FeO	6.43	.089	.965	1.009
MnO	trace	.000		
MgO	34.94	.874		
CaO	0.13	.002		
Na ₂ O	0.22	.003		
K ₂ O	0.01	.000		
H ₂ O+	0.13			
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100.51				

Enstatite, Espedalen, Norway. Washington analyst.

It will be seen that the molecular ratios of the SiO₂+TiO₂ and (Fe, Mg, Ca)O are nearly equal. The small amounts of alumina and alkalis may be ascribed to the micaceous (?) mineral, and the Fe₂O₃ to slight oxidation.

HYPERSTHENE, NAIN, LABRADOR

The material studied was a large crystal, obtained from the U. S. National Museum, No. 93,527. The color is a slightly grayish black, with a marked silky luster on the cleavage surfaces. Microscopic study shows that the mineral contains from 5 to 10 per cent of finely lamellar intergrowths of what appears to be a monoclinic pyroxene, which has decidedly lower refractive indices than the hypersthene. There is also less than 1 per cent of a dark brown mineral in extremely thin plates. The hypersthene itself is practically colorless. The refractive indices were found by Merwin to be: $\alpha=1.690$, $\gamma=1.700$. These values are very slightly smaller than those found by Michel Lévy and Lacroix for Labrador hypersthene.³ L. H. Adams found the density of the specimen as a whole to be 3.415 at 29°.

An analysis was made of material carefully selected and free from a rusty brown secondary substance which forms thin coatings along cracks. The powder was dried at 110°. Two earlier analyses are given for comparison.

	1	2	3	4
SiO ₂	51.81	.864	49.85	51.36
TiO ₂	0.76	.009	n.d.	n.d.
Al ₂ O ₃	2.16	.021	6.47	0.37
Fe ₂ O ₃	4.52	.028	2.25	n.d.

³ Michel Lévy and Lacroix, *Minéraux des Roches*, 262, 1888.

FeO	13.96	.194	14.11	21.27
MnO	0.16	.002	0.67	1.32
MgO	24.57	.614	24.27	21.31
CaO	1.95	.035	2.37	3.09
Na ₂ O	0.39	.006	n.d.	n.d.
K ₂ O	0.03	.000	n.d.	n.d.
H ₂ O+	0.19		n.d.	n.d.

	100.50		99.99	98.72
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Sp. gr.	3.415		3.402	3.392
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1. Hypersthene, Nain, Labrador. Washington analyst.
2. Molecular ratios of No. 1.
3. Hypersthene, Labrador. F. Remelé analyst. *Zeits. deutsch. geol. Ges.*, 21, 658, 1868.
4. Hypersthene, Labrador. A. Damour analyst. *Ann. Mines*, 5, 137, 1844.

The alumina and most of the ferric oxide of No. 1 are to be considered, as in the case of augite⁴ as existing in solid solution in the hypersthene and in the monoclinic pyroxene, and not as in the Tschermak molecule. The soda may be regarded as entering acmite. The composition of the Nain hypersthene is calculated to be as follows:

MgSiO ₃	57.90
FeSiO ₃	25.87
CaMgSi ₂ O ₆	7.56
NaFeSi ₂ O ₆	2.77
(Al, Fe) ₂ O ₃	5.72
	<hr/>
	99.82

The molecular amount of silica needed for this composition is .869, while .864 is shown in the analysis. The molecular ratio of MgO to FeO is very close to 3:1, being almost exactly so (.579 : .196) when .035 MgO is allotted to form diopside. We may reasonably assume that much, if not all, of the diopside and acmite present form the monoclinic pyroxene intergrown with the hypersthene, and the amount calculated above corresponds roughly with that shown by the microscope. It is probable that part, at least, of the TiO₂ is present, perhaps, as ilmenite, in the small plates of the dark brown mineral.

Attention should be called to the fact that the optical data given above were determined on the hypersthene substance, not on the small amount of monoclinic pyroxene, so that they do not apply strictly to the substance as analysed, in which the intergrown material was necessarily included.

⁴ Washington and Merwin, *Am. Jour. Sci.*, 3, 119, 1922.

ACTINOLITE, KRAGEROE, NORWAY

Adams and Williamson determined the compressibility of the actinolite of Krageroe, using a large crystal which had been collected and given to them by Dr. Olaf Andersen. In accordance with the general plan, a chemical analysis of this was begun and had been almost completed before it was discovered that actinolite from Krageroe had been analysed by Stanley.⁵ Our analysis was, however, completed, and the optical characters were determined on our material, so that they might be compared with those determined by Ford⁶ on material from the same locality.

In the mass the mineral is slightly brownish black. Sections 0.1 mm. thick are pleochroic in dull yellow to greenish yellow, Ridgway's 21''' to 23''', and show the usual absorption formula. Powder 0.1 to 0.01 mm. is dark dull greenish yellow, Ridgway's 25'''k.

Adams determined the density as 3.079 at 28°, while Penfield and Stanley give the average specific gravity as 3.127.

Our material is practically homogeneous, with refractive index β varying from 1.650 to 1.653. If we assume similar variations in α and γ , their values, corrected from direct measurements, are 1.636 and 1.660, respectively.

The extinction angles of thin flat cleavage flakes from several large fragments were 15° to 17°, whereas numerous thin splinters from the same material powdered, as well as that used for analysis, showed extinctions of 20° to 22°. The estimated optic axial angle, from observation on the powder and by calculation from the refraction indices, is about 75°. By means of Daly's⁷ diagrams $c \wedge \gamma = 16^\circ$, as estimated from the cleavage flakes. This does not agree as well as had been anticipated with the value, 22°, estimated from the powder, probably because the grains in the powder were tilted with respect to c . The extinction angle and the refractive indices in our material are greater than those found by Ford.

Our analysis was carried out on the powder dried at 110°. Stanley's determination of fluorine was accepted.

	1	2
SiO ₂	51.86	51.85
TiO ₂	1.92	1.26
Al ₂ O ₃	3.81	4.36

⁵ Penfield and Stanley, *Am. Jour. Sci.*, **23**, 34, 1907.

⁶ W. E. Ford, *Am. Jour. Sci.*, **37**, 180, 1914.

⁷ R. A. Daly, *Proc. Am. Acad.*, **34**, 311, 1899.

Fe ₂ O ₃	2.19	2.58
FeO	5.97	5.46
MnO	0.04	0.35
MgO	19.40	19.48
CaO	10.73	10.60
Na ₂ O	2.16	2.15
K ₂ O	0.28	0.35
H ₂ O+	0.98	1.21
F ₂	(0.46)	0.46
	<hr/>	<hr/>
	99.80	100.24
O=F	0.22	0.22
	<hr/>	<hr/>
	99.58	100.02

1. Actinolite, Krageroe, Norway. Washington analyst.

2. Actinolite, Krageroe, Norway. Stanley analyst. *Am. Jour. Sci.*, 23, 34, 1907.

The two analyses resemble each other very closely, so closely, indeed, for most of the constituents that these might be considered as duplicate determinations. It may be worthy of note that Stanley used the basic acetate method for the separation of iron and alumina from magnesia, whereas we used the simpler method of a triple precipitation with ammonia water in the presence of considerable ammonium chloride. The difference in result as regards magnesia is negligible, and the slightly higher alumina in Stanley's analysis may be attributed to some slight difference in the colorimetric determination of titanium, as the sum $Al_2O_3 + TiO_2$ is almost identical in the two analyses.

SCHOEPITE, A NEW URANIUM MINERAL FROM KASOLO, BELGIAN CONGO¹

T. L. WALKER, *University of Toronto*

Recently Professor Schoep² described six new uranium minerals from Kasolo in the Belgian Congo. These occur along with torbernite and uranotile apparently as alteration products of uraninite. The writer was fortunate in securing for the Royal Ontario Museum of Mineralogy a suite of specimens representing the various associated minerals. An examination of the specimens showed that there is still another mineral in this association. It is well crystallized but, unfortunately, there is not sufficient material for a quantitative chemical analysis.

¹ Read at the meeting of the Mineralogical Society of America, Ann Arbor, Michigan, Dec. 29, 1922.

² *Comptes Rendus*, 1921 and 1922.

The mineral in question closely resembles Schoep's becquerélite, being sulphur yellow in color, and adamantine in lustre. The crystals are seldom more than one and a half mm. in length, and about one mm. in diameter. They possess one very perfect cleavage (001). When examined under the microscope, most of the cleavage plates are found to be transparent, lemon yellow in color, and exhibit no pleochroism. The indices of refraction in such plates as determined by the immersion method are $\beta = 1.714$ and $\gamma = 1.735 \pm .003$. Fragments resting on one of the faces of the prismatic zone show strong pleochroism, Y or Z, lemon yellow, X colorless. In such plates α was found to be $1.690 \pm .003$. Since in all plates the extinctions are parallel to the cleavage or to the crystal edges, the mineral on optical grounds appears to be orthorhombic. The acute bisectrix is normal to the cleavage so that the basal plates show good interference figures with a large optical angle. The mineral is optically negative, $\rho > \nu$.

The powdered mineral reacts in microcosmic salt for uranium. If a few fragments be mounted on a slide in hydrochloric acid and observed with the microscope, the mineral is seen to dissolve readily with the evolution of small bubbles. From these scanty data one might suggest that the mineral is a carbonate of uranium.

Three crystals were measured on the two-circle goniometer. The results indicate that the mineral is orthorhombic. Eleven forms were observed as shown in the accompanying table.

TABLE SHOWING FORMS OBSERVED ON SCHOEPITE

LETTER	FORMS	OBSERVED		CALCULATED		FACES
		ϕ	ρ	ϕ	ρ	
<i>c</i>	(001)	0	0	3
<i>a</i>	(100)	90°	90°	90°	90°	6
<i>b</i>	(010)	0	"	0	"	5
<i>m</i>	(110)	67°10'	"	66°54'	"	3
<i>d</i>	(011)	0°	41°10'	0°	41°11'	6
<i>f</i>	(021)	"	60°19'	"	60°15'	6
<i>e</i>	(041)	"	75°	"	74°04'	1
<i>x</i>	(104)	90°	27°06'	90°	27°09'	2
<i>o</i>	(122)	49°41'	53°22'	49°33'	53°26'	4
<i>q</i>	(124)	49°33'	33°58'	"	33°59'	2
<i>p</i>	(111)	66°57'	65°53'	66°54'	65°51'	9

The relative size of the faces of the different forms present is shown in Figure 1.

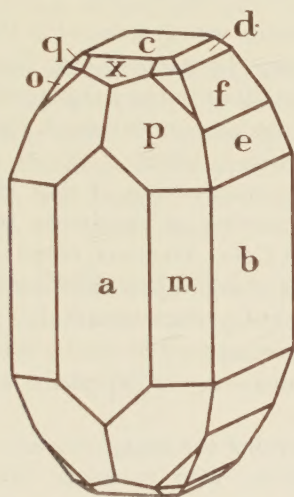


FIGURE 1. SHOWING DEVELOPMENT OF SCHOEPITE CRYSTALS

From the above measurements the crystallographic constants are as follows:—

$$p_o : q_o : r_o = 2.053 : 0.875 : 1$$

$$a : b : c = 0.426 : 1 : 0.875$$

It is worthy of note that so many of the secondary uranium minerals are biaxial, negative, with X colorless, and normal to perfect cleavage or tabular development, while Y and Z are almost identical in some shade of yellow. This peculiar regularity seems to be quite independent of the nature of the uranium compound as shown by the following list of minerals: bassetite, uranospinite, gilpinite, uranocircite, uranophane, schroeckingerite, zippeite, phosphuranylite, and tyuyamunite.

As this mineral appears to be quite distinct in optical and crystallographic properties from all known uranium minerals, the writer proposes to name it schoepite in honor of Professor Alfred Schoep, of the University of Ghent, who has contributed so much to our knowledge of the secondary uranium minerals from the Congo.

CATAPLEIITE FROM MAGNET COVE, ARKANSAS

WILLIAM F. FOSHAG, *National Museum, Washington, D. C.*

The mineral catapleiite was first found in the nepheline syenites on the Island of Låven, Langesundfjord, Norway. Later it was discovered in other localities in the Langesundfjord region. It has again been found at the famous Narsarsuk locality near Fredrickshavn, western Greenland, where it occurs as one of the most abundant minerals in the syenites of that locality. The writer, while examining a number of specimens from the syenite localities about Magnet Cove, Arkansas, noted some small yellowish, hexagonal plates that proved upon examination to be catapleiite. The syenites of Magnet Cove are remarkably poor in titanium and zirconium minerals as compared to similar syenites in Norway and Greenland, and the discovery of catapleiite at this locality is not entirely unexpected.

The specimens carrying the catapleiite are dike rocks made up of feldspar and aegirite, with accessory titanite and secondary natrolite. The aegirite occurs in two forms; lustrous black prisms up to 3 cm. in length ramifying in all directions through the feldspar and projecting into mariolitic cavities; and small acicular needles of a brown color forming radiating masses on the other minerals. The feldspars are somewhat dull and contain numerous solution cavities in which occur groups of catapleiite crystals. Similar specimens having a less corroded appearance carry eudialyte and eucolite but no catapleiite.

The catapleiite forms hexagonal plates up to 3 mm. in diameter and 1 mm. in thickness. Single crystals are rare, the common occurrence being in crystal aggregates. The color is yellow (ivory yellow) sometimes with a faint suggestion of pink. They are not transparent but translucent, usually somewhat porcelain-like in appearance. The forms noted (referred to the hexagonal system) are 0001, $10\bar{1}1$, $10\bar{1}2$, and $10\bar{1}0$. The faces gave good signals but the measurements did not show very close agreement among themselves. This has also been found to be true of the specimens of the mineral from other localities. The following angles are sufficiently close to those of catapleiite as to leave no doubt as to their form.

	MAGNET COVE	NORWAY	GREENLAND
$10\bar{1}2 \wedge 0001$	$37^{\circ}33'$	$38^{\circ}12'$	$37^{\circ}57'$
$10\bar{1}1 \wedge 0001$	$56^{\circ}32'$	$57^{\circ}34'$	$57^{\circ}20'$

The Greenland mineral often shows a striking iridescence, the base giving red reflections, the prism blue or green. On the goniometer the Magnet Cove mineral shows a striking red reflection from the base.

The catapleiite from Magnet Cove is positive in optical character with small axial angle. The angle varies somewhat from 0° to 15° . Much of the material is essentially uniaxial, other specimens show a decided opening of the cross. A comparison of the optical properties of the Magnet Cove material with that of Greenland is given in the table below:

OPTICAL PROPERTIES OF CATAPLEIITE

	MAGNET COVE	GREENLAND
α	1.593	1.591
β	1.593	1.592
γ	1.628	1.627
2V	0° - 15°	25°
Character	positive	positive
Orientation	$Z=c$	$Z=c$

A sufficient amount of material was not available for analysis but the optical and crystallographical properties of the mineral place it quite definitely as catapleiite.

The catapleiite specimens are free of eudialyte and eucolite while the eudialyte-eucolite bearing rock is fresher and shows no catapleiite. Brögger remarks that the Norway catapleiite bearing rock is also remarkably free of eudialyte-eucolite. Grains of eudialyte are common showing alteration to eucolite. The catapleiite occurs commonly in the solution cavities in the feldspar, is decidedly later than the other minerals and appears to be contemporaneous with the zeolites. These relations indicate a derivation of the catapleiite from eudialyte through eucolite by hydration.

Although catapleiite does not seem to have been noted before at Magnet Cove, Williams¹ makes the following statement under the heading "Brucite." "Brucite occurs in white transparent or semi-transparent regular hexagonal plates which are generally about 2 mm. in diameter but may be found much smaller. They present a laminated surface and show a decided cleavage parallel to the base. The faces which have been observed are 0001, $20\bar{2}1$, 0441. The angles were not measured but it is evident from

¹ Annual Report of the Geological Survey of Arkansas, vol. 2, 1890.

the appearance of the crystal that the faces enumerated are those which exist. In parallel light a plate parallel to the base becomes dark grey but shows variations of intensity in the different parts of the plates. In convergent light a black cross is observed which opens slightly when the stage is revolved. The size of the optic angle in different parts of the plate is very variable from one point to another. By means of a quarter undulation mica plate the character of the double refractions was determined as positive." This description fits that of catapleiite in so many respects as to leave little doubt of the identity of this mineral with catapleiite.

A NEW MODE OF OCCURRENCE OF STRUVITE¹

CHARLES PALACHE, *Harvard University*

In the summer of 1920 the writer received from Mr. C. H. Hickey of the Food and Drug Inspection Station in Boston some crystals, the identification of which was desired. The crystals were found in canned shrimp from Biloxi, Miss. Attention had been called to them by their hard, gritty character and their insolubility in either hot or cold water.

One of the few, minute, white crystals submitted proved measurable on the goniometer. It was found to be a twin crystal of orthorhombic system but in the absence of any chemical data its nature was not established. Later more of the material was secured by the chemists of the Station and qualitative tests were obtained for magnesium, ammonia and phosphorus. With this information it was easy to identify the crystal as struvite and renewed study of the forms revealed the characteristic hemimorphism of that mineral. As shown in the figure the crystal was elongated in the direction of the a axis, twinned on the basal pinacoid, and deeply grooved on both sides. Other crystals were flattened parallel to the twin plane. They showed cleavage and optical characters which agreed with the data given for struvite in Dana (Syst. p. 806).

The forms observed were the following:— $b(010)$; $c(001)$; $p(120)$; $S(101)$; $s_1(10\bar{1})$; $h(021)$; $h_1(02\bar{1})$; $t(121)$.

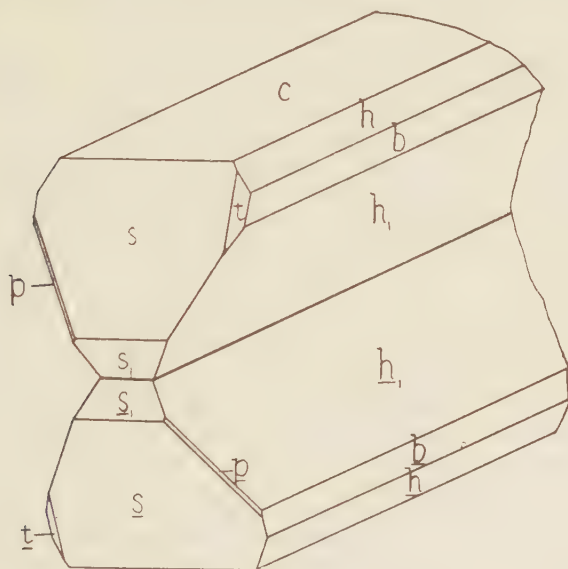
The reflections were poor but the following angles show the nature of the agreement of measured with calculated values:—

¹ These crystallographic notes and the figure of struvite have already been published in a paper by C. S. Purcell and C. H. Hickey. Note on an Occurrence of Struvite in Canned Shrimps, *The Analyst*; London. A reprint seemed desirable.

	MEASURED	CALCULATED
001 to 101	57°56'	58° 09½'
001 to 10 $\bar{1}$	58 35	58 09½
001 to 021 (4)	61 29	61 16
010 to 120 (2)	48 33	48 34

The distribution of the faces of the forms *p* and *t* indicated a lower symmetry than is usually ascribed to struvite; but the material was too poor and too limited in amount to permit of satisfactory conclusions being reached on this point.

Mr. Hickey states in a letter:—"***** as we found some of the crystals in a freshly opened can of shrimp, it is our opinion ***** that the presence of ammonia in the substance, due to the breaking down of the protein of the shrimp, indicates decomposition."



TWIN CRYSTAL OF STRUVITE

This mode of formation is in agreement with that of other occurrences of struvite; it is a *guano* mineral and has been formed in artificial cultures as a product of bacterial fermentation. The nearest parallel to the present occurrence of struvite is recorded by Arzruni² who described minute crystals found in a bottle of peptonized meat; they were however of an entirely different habit.

² *Zeit. f. Kryst.*, 18, 60, 1890.

PROCEEDINGS OF SOCIETIES

NEW YORK MINERALOGICAL CLUB

*Meeting to Celebrate the Centenary of the Birth of Louis Pasteur
Wednesday, December 27, 1922*

The New York Mineralogical Club associated with The American Museum of Natural History, The Alliance Francaise de New York, The American Scenic and Historic Preservation Society, The Department of Agriculture, The Department of Health of the City of New York, The Federation de l'Alliance Francaise, The French Institute in the United States, The New York Academy of Medicine, The New York Academy of Science, The Pasteur Laboratories of America, The State Department of Health, and The Rockefeller Institute for Medical Research celebrated the centenary of the birth of Louis Pasteur, in the Auditorium of the American Museum of Natural History on the evening of Wednesday, December 27, at 8:15 p. m.

The speakers on this occasion were: Dr. Royal S. Copeland, N. Y. Commissioner of Health; Hon. Henry S. Wallace, Secretary, Dept. of Agriculture; Dr. George David Stewart, President, N. Y. Academy of Medicine; Major Henry J. Nichols, Medical Corps, War Department; Dr. George F. Kunz, President, New York Mineralogical Club; Dr. Pierre Lacomte du Nouy, Rockefeller Institute for Medical Research; Prof. Henry Fairfield Osborn, President, American Museum of Natural History; Hon. Gaston Liebert, Consul General of France; Dr. Herman Biggs, State Department of Health; and Dr. C. E. A. Winslow, Yale University.

A series of stereopticon views were also shown.

HERBERT P. WHITLOCK, *Recording Secretary.*

NEW YORK MINERALOGICAL CLUB

Regular Monthly Meeting of January 10, 1923

The regular monthly meeting of the New York Mineralogical Club was held in the Assembly Room of the American Museum of Natural History on the evening of Wednesday, January 10th at 8 P.M. In the absence of the President, the Vice President, Mr. George E. Ashby, presided. Seventeen members were present.

The Committee on Membership reported favorably on the name of Mr. J. S. Griggs, proposed at the November meeting, and the Secretary was instructed to cast a ballot for his election.

Mr. Cabeen exhibited a specimen of pentlandite from Sudbury which showed cleavage, he also extended greetings to the Club from Professor J. F. Kemp of Columbia University. Mr. Papke showed some striking specimens of apophyllite from Snake Hill, N. J.

The Chairman then introduced the speaker of the evening, Mr. O. Ivan Lee, who read a paper on "*The Minerals of the Rarer Earths.*" In the course of the discussion, Mr. Lee suggested that the beryllium contained in such minerals as herderite, bertrandite etc., was derived from beryl, citing the instance of these rare beryllium minerals occurring notably on etched beryl. He also spoke of the application of the direct vision (comparison) absorption spectroscopy for the

determination of fluocerite and certain monazites high in neodymium (and praseodymium). The mineral may be examined by reflected light without recourse to flame or chemical treatment. He also called attention to the very intimate association of monazite with uraninite alterations as found at the Deake Mine, near Sprucepine, Mitchell Co., N. C.

Notable among the unusual specimens exhibited as illustrating his paper were, kunzite from Rumford, Me.; transparent pollucite from Brazil (with cut stone weighing 1.6 carats); aguilinite from the San Carlos Mine, Guanajuato, Mexico; cossyrite from Cuddia Mida, Pantellaria Island near Sicily; berzelianite from Skrikerum, Sweden; brannerite from the head of Kelly Gulch, Stanley Basin, Idaho; an ilmenite crystal from Judge Martin Place, near Sprucepine, Mitchell County, N. C. (unreported locality discovered by Mr. Lee in 1907); a sipylite crystal weighing 47.25 gm. from the northwest slope of the (Bald) Friar Mountain, near Lowesville, Amherst Co., Va. A specimen of ductile, metallic tantalum was also shown. This was first made in America in 1922 by the Fansteel Products Co. of North Chicago.

At the close of his paper a vote of thanks was tendered to Mr. Lee for his very interesting presentation. The meeting then adjourned.

HERBERT P. WHITLOCK, *Recording Secretary*

PHILADELPHIA MINERALOGICAL SOCIETY

Academy of Natural Sciences of Philadelphia, February 8, 1923

A stated meeting of the Philadelphia Mineralogical Society was held on the above date with the president, Mr. Vaux, in the chair. Fourteen members and three visitors were present.

Mr. Harry A. Warford addressed the society on "*The Garnets*." The physical properties, composition, modes of occurrence, and classification of the garnets was described in detail. Many specimens were exhibited.

The chair announced the death, on January 27th, of Mr. Clarence S. Bement, and related reminiscences of his mineralogical activities.

Mr. Vaux exhibited specimens of allactite from Franklin, N. J.

SAMUEL G. GORDON, *Secretary*

BOOK REVIEWS

AN INTRODUCTION TO SEDIMENTARY PETROGRAPHY. HENRY B. MILNER. Cr. 8 vo., 125 pages, 16 plates. Thomas Murby & Co., 1, Fleet Lane, E. C. 4, London, 1922. (D. Van Nostrand Co., 8 Warren St., New York).

This small handbook, consisting of only four chapters, will be favorably received, no doubt, by all petrographers and students of stratigraphy. It is designed to meet the requirements of all those engaged in a microscopical examination of loose, detrital deposits and treats especially of the principles, practice, scope and limitations of correlation by means of heavy concentrates. While the book is based largely on a course of lectures in sedimentary petrography as applied to oil technology, the author realizes that the methods employed are applicable to a far greater field in both theoretical and applied geology.

Correlation by petrographic methods is rendered possible by noting (1) the frequency of occurrence of individual species, (2) the persistence of each species (lateral and vertical distribution), and (3) the constancy or inconstancy of mineralogical features of species. Comparison of grain size of the same species and the percentage of heavy residue in a series are supplementary factors of considerable importance.

Tables listing the crystallographic, physical and optical properties of fifty-five detrital minerals are given in 56 pages of text. These tables together with 16 plates of exceptional clarity constitute the main portion of the book, which closes with a brief discussion of the bearing of sedimentary petrography on palaeogeographical problems. A bibliography of 82 entries is appended.

W. F. H.

GRAPHICAL AND TABULAR METHODS IN CRYSTALLOGRAPHY. T. V. BARKER. 152 pages. Thomas Murby and Co., *London*, 1922. (American price \$4.25).

The main purposes of this work are stated by its author to be "to provide the researcher with a select collection of exact graphical methods, which personal experience has proved to be both accurate and time-saving; to discuss the relation of these methods to formal processes of computation; and finally, to outline a new system of practice."

The first chapter deals with a crystallographic protractor, a useful instrument the price of which (30 shillings) seems however rather excessive. The second takes up the stereographic projection and the solution of problems by its aid. The great advantages of the two-circle method of measurement are emphasized. The gnomonic projection is then similarly treated, and the use of a combination of the two projections is urged. A chapter is also devoted to the graphic determination of indices.

The Goldschmidt method of crystal drawing is shown to be superior to all others, and is described in detail. The usefulness in crystallographic calculations of a multiple tangent table is pointed out. The table given in an appendix consists of a series of angles between 5 and 87° with 3' intervals, arranged in columns headed 1, 2, 3, 4, 5, and so related that the tangent of one of them is equal to the indicated multiple of another in the same row.

In Chapter 8 is described the author's "new system of practice." It is shown that in the triclinic system at least the axial ratio-angle mode of stating the data is undesirable, and a series of interfacial angles, such as was at one time used, would be preferable. In describing a substance, it is urged that doubtful forms be not recorded, that Miller symbols alone be given, and that a standard series of crystallographic letters be adopted so that for certain forms only a letter and not even the Miller symbol need be stated. Over-measurement should be avoided, 2 or 3 crystals giving results are as useful as 5 or 10. It is thought that nothing is gained by stating limits of variation in angles measured. The mutual adjustment of fundamental angles by means of the multiple tangent table is suggested, but Goldschmidt's plan of averaging the results of all reasonably dependable measurements is not favored. In general, the publication of theoretical angles for all the forms is discouraged. The fuller use of projections leads to a reversal of the usual procedure,—angles are now to be calculated logarithmically, then checked graphically.

By way of illustration, the data for a triclinic substance are given, and it is shown that if all the suggestions listed above are adopted, only one fourth as much space as heretofore would be required for recording the data, and of course a marked economy of time would be effected.

On the whole, the impression produced by this book is favorable. The saving of the scientist's time, and of publication space, are both urgent necessities in these days. The reviewer feels, however, that Dr. Barker has gone somewhat too far, and is recommending procedures which render the interpretation of published data unduly difficult. If all authors were equally skilled in interpreting their measurements, the omission of angle ranges might be permissible, but since as a matter of fact one student can often improve on the work of a predecessor, the recording of full data is likely to be of real value. The slight additional time needed to adjust fundamental angles by the measurements of all forms seems well justified by the increase in knowledge of the crystal thus obtained. The failure to publish values which have been calculated, or their publication in such an obscure form that it is a puzzle to interpret them, will merely result in the need for others to duplicate the original work. The "new system of practice" resolves itself then into a few valuable suggestions, and a number of attempted simplifications which seem likely to make the way less easy for future crystallographers.

W.

NOTES AND NEWS

Every mineralogist will regret to learn of the death of Dr. Mauzelius, chemist of the Swedish Geological Survey, whose great skill in determining rare elements, although present in small amounts, has led to the establishment of numerous new mineral species.

Dr. Rudolph Koechlin has retired from the Directorship of the Mineralogical Division of the State Natural History Museum in Vienna, and has been succeeded by Dr. Hermann Michel.

In the review of Samuel G. Gordon's book, *The Mineralogy of Pennsylvania*, published in a recent issue of *The American Mineralogist* (vol. 8, p. 12) the price was erroneously given as \$3.75 instead of \$2.75.

Grants for research made by the American Association for the Advancement of Science include in the field of geology the following concessions: V. C. Allison, Bureau of Mines, Pittsburgh, Pa., \$150 for assistance in a study of rate of growth in a micro-chemical study of oils, shales and coal.

We congratulate the Board of Trustees of the University of Chicago in their announcement that Professor R. A. F. Penrose, Jr., of Philadelphia, has *again* contributed five hundred dollars to help provide the full eight issues during the year of the *Journal of Geology*.

A new mineralogical society, to be known as *The Mineralogical Society of Washington, D. C.*, was organized Friday, February 23, 1923. The transactions of the first meeting, held at the residence of Dr. W. T. Schaller, will be given in detail in an early issue of this Journal.

Drs. D. Coster and G. Hevesy of the Copenhagen Institute for Theoretical Physics have recently announced the discovery of a new element with atomic number 72, for which the name *hafnium* was proposed. The discovery was the result of X-ray spectroscopy upon extractions from zirconium minerals. As much as 5% of this element was found in samples of commercial zirconium oxide.

We deeply regret to note the death of the veteran mineral collector, Mr. Clarence S. Bement of Philadelphia, Pa. His love for minerals and keen appreciation of fine specimens resulted in a magnificent private collection, which in 1900 was sold to the late J. P. Morgan, whose name it now bears. The collection is now displayed in the American Museum of Natural History in New York City. An extended notice of Mr. Bement's life will appear later.

Richard V. Ageton, of the Bureau of Mines, who has been doing examination work for the War Minerals Relief Commission, is acting as assistant chief mining engineer of the bureau.

Sir William H. Bragg, Quain professor of physics in the University of London, has been elected a corresponding member of the Paris Academy of Sciences in the section of physics.

All crystallographers will regret to hear of the death of Professor Karel Vrbna, aged 77 years, formerly Professor of Mineralogy at the Bohemian University of Prague, Bohemia.

ABSTRACTS—MINERALOGY

EXPERIMENTS ON THE ARTIFICIAL PRODUCTION OF DIAMOND. C. A. PARSONS. *Phil. Trans. Roy. Soc.*, **220**, 67-107, 1919. THE FORMATION OF DIAMOND. C. A. PARSONS. *J. Inst. Metals*, **20**, 5-24, 1918; both thru *Min. Abstr.*, **1**, 232, 1921.

The conclusion reached from several thousand experiments is that pressure is unessential to the artificial production of diamond, and that the diamond is produced from occluded gases in the iron after solidification of the metal. E. F. H.

METALLIC COPPER IN A METEORIC VEIN. T. T. QUIRKE. *Econ. Geol.*, **14**, 619-24, 1919.

The Richardson meteorite contains small flakes of copper in veins of nickeliferous iron and troilite. E. F. H.

THE PIPERNOID TUFFS OF CAMPANIA, AND THEIR MINERALS. F. ZAMBONINI. *Mem. Descr. Carta Geol. Italia*, **7**, pt. 2, 130 pp., 1919; thru *Min. Abstr.*, **1**, 106, 1920.

The following minerals are described: fluorite, new forms (553), (774), (766); nocerite; hydromagnesite; hydrodolomite; sanidine; acmite-augite; microsommite; marialite; fluosiderite; grothine; biotite rich in CaO (14%) and hornesite. Analyses, optical determinations, and crystallographic measurements are given in most cases. E. F. H.

PLEOCHROISM IN A TIN-BEARING MINERAL FROM SIAM. J. B. SCRIVENOR. *Geol. Mag.*, **56**, 123-4, 1919.

A uniaxial, +mineral, probably cassiterite (Sn 74.50%, sp. gr. 6.913) is strongly pleochroic, green to deep-red; this may be due to the content of TiO_2 (0.17%).

E. F. H.

ON AN UNUSUAL MICA IN NEPHELINE-SYENITE OF FUKUSHIN-SAN, KOREA. S. TSUBOI. *J. Geol. Soc. Tokyo*, **26**, 7-9, 1919; thru *Min. Abstr.*, **1**, 209, 1921.

Plates of biotite showed c (100), ρ ($\bar{2}05$), ψ (011), q (114), ξ (135). $\alpha = 1.614$, β 1.671, γ 1.672, α to (001) = $1^\circ 13'$ in front, $\beta = b$.

E. F. H.

POLARIZED LIGHT IN THE STUDY OF ORES AND METALS. F. E. WRIGHT. *Proc. Am. Phil. Soc.*, **58**, 401-47, 1919.

The results of a mathematical discussion of the reflection of light by absorbing media indicate that it is possible to detect anisotropism and to determine the optical directions in polished sections of opaque minerals.

E. F. H.

COLORING MATTERS OF RED AND BLUE FLUORITE. C. S. GARNETT. *J. Chem. Soc. London*, 1920, Trans. Vol. **117**, 620-622.

Fluorite of a deep blue to black color from Derbyshire was treated with chloroform, benzene, and ether. The carbon content fell from 0.27 to 0.207%. The powder when heated becomes colorless and a bituminous odor is observed, while a black carbonaceous residue results when heated with conc. H_2SO_4 . Thin sections show that the organic matter is present as films parallel to the cube faces and at the contacts of the crystals. Red fluorite from near Ashover, Derbyshire, owes its color to some rare earth mineral soluble in HCl or HNO_3 . Heating has no effect.

W. F. H.

ON GEARKSUTITE AT GINGIN, WESTERN AUSTRALIA. EDWARD S. SIMPSON. *Mineralog. Mag.*, **19**, 23-39, 1920.

Gearksutite, a hydrous fluoride of Al and Ca, has heretofore been reported from only 3 localities. The genesis and mode of occurrence of the Australian material are entirely different from those previously described. At Gingin the mineral occurs as nodules in a narrow clayey bed in Cretaceous phosphatic green-sand, associated with quartz, fluorapatite, glauconite, microcline, kaolinite and halloysite. Mean refractive index 1.445; sp. gr. 2.71-2.72. An analysis showed Al 15.38; Ca 22.13; Na 0.06; K 0.06; F 41.26; H_2O - 0.12; $\text{H}_2\text{O} +$ 15.88; O 4.88; Fe_2O_3 0.03; K_2O 0.01; quartz 0.19; indicating a co-crystallization of the two end members $\text{CaF}_2 \cdot \text{AlF}_2 \cdot \text{OH} \cdot \text{H}_2\text{O}$ and $\text{CaF}_2 \cdot \text{AlF}(\text{OH})_2 \cdot \text{H}_2\text{O}$ in the proportion of 86.5 to 13.5. Heated rapidly in a closed tube it gives off water and HF and is readily soluble in cold dilute acids. In Greenland, Colorado, and the Urals gearksutite and the associated fluorides seem to have been formed by the action of HF of magmatic origin upon pre-existing feldspars, at Gingin the mineral has been formed *in situ* by carbonated water acting upon fluorapatite and gibbsite.

W. F. H.

THE 'SKARN' OF VĚCHŇOV AND ITS MINERALS. F. SLÁVIK. *Časopis Moravského Musea Zemského*, **1919-21**, 305-13; through *Min. Abstr.*, **1**, 290.

The following minerals are recorded from a 'skarn' in a magnetite deposit at Vechňov in Moravia: hedenbergite, andradite, epidote, amphibole, adularia, and magnetite (sometimes pseudomorphous after hedenbergite).

E. F. H.

OPTICAL DATA ON SEVERAL MINERALS. F. SLAVÍK. *Rozpravy České Akad., class 2*, **26**, (60), 8 pp.; *Bull. Intern. Acad. Bohême*, **22**, 32-8; through *Min. Abstr.*, **1**, 290-1.

The following indices of minerals are noted: bauxite 1.60 to 1.61, wavellite 1.545 (γ), fischerite 1.533, fouchérite 1.64-1.65, picite 1.64, phosphorite 1.620-1.625, 1.615, collophanite 1.58, 1.60, zippeite 1.635 and 1.645, sphaerite 1.563 and 1.575, zepharovichite 1.55, gibbsite 1.56-1.565 and 1.573, destinezite 1.64, szaibelyite 1.575 and 1.60. Localities are given in each case. E. F. H.

TETRADYMITITE FROM THE BOHEMIAN GOLD VEINS. F. SLAVÍK. *Rozpravy České Akad., class 2*, **25**, (53), 5 pp., 1916; *Bull. Intern. Acad. Bohême* **22**, 100-02, 1918; through *Min. Abstr.*, **1**, 291.

Tetradymite or another Bi sulphide and telluride occurs in small tin-white scales in auriferous quartz veins in three central Bohemian localities. E. F. H.

CONTRIBUTION TO THE MORPHOLOGY OF BENITOITE. B. JEŽEK. *Rozpravy České Akad.*, **28**, (8), 5 pp. 1919; through *Min. Abstr.*, **1**, 291.

Two new forms are described: (2027) and (3144). Ditrigonal-pyramidal symmetry is supported by the hemimorphic development of several pyramids. E. F. H.

THE CLASSIFICATION OF METEORITES. G. T. PRIOR. *Mineralog. Mag.*, **19**, (90), 51-63, 1920.

The earlier classifications were based largely upon mineral comp. and structure and little or no stress placed upon chem. composition. The scheme advocated for both meteoric irons and stones depends upon the amount of Ni in the nickeliferous iron and upon the proportion of FeO to MgO in the magnesium silicates. The four classes of meteorites—irons, stony-irons, chondritic stones and non-chondritic stones—are each subdivided into four groups, each group possessing a comp. falling within definite limits in regard to Ni-Fe and ferrous oxide. W. F. H.

NOTE ON THE PLUMBIFEROUS BARYTES FROM SHIBUKURO, PREFECTURE OF AKITA, JAPAN. R. OHASHI. *Mineralog. Mag.*, **19**, (90), 73-76, 1920.

The plumbiferous barite is being deposited from hot springs and forms concentric bands of white and brownish yellow coatings on pebbles and rocks. Sp. gr. 4.62. Indices of refraction between 1.65 and 1.70. $2E = 67-86^\circ$ (Mallard's method). Dispersion strong, $\rho > \nu$. The quantity of Pb varies from 4.67 to 17.76, the yellow zones containing the larger amount. Based upon chem. comp. the mineral corresponds to the mixtures $A_1B_{14}-A_1B_3$ (A = anglesite, B = barite), while the material from Hokuto corresponds to $A_1B_3-A_3B_6$. All the barite from Shibukuro, whether it contains Pb or not is radioactive. It is inferred that the mineral has a self-luminescent property in addition to the radioactivity. W. F. H.

THE CRYSTAL FORM, FLUX, AND ACTUAL MELTING OF PHOSPHORESCENT ZINC SULFIDE. ERICH TIEDE AND ARTHUR SCHLEEDE. *Ber.*, **53**, 1721-5, 1920.

A relation between crystal form and capability of phosphorescence could not be established for artificial sphalerite and wurtzite. The action of a flux in producing phosphorescence may be replaced by an actual fusion of the sulfide. E. F. H.